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TECHNICAL REPORT NO. 74-44

ROPE KIT,
SPECIAL PURPOSE MOUNTAINEERING AND RIVER CROSSING

by

Joseph L. Carney
Environment and Survival Branch

April 1974

Final Report

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U. S. ARMY LAND WARFARE LABORATORY

Aberdeen Proving Ground, Maryland 21005

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20. Abstract (Cont'd)

principal exception that the 120' long 7/16" diameter polypropylene core/nylon braid cover rope was replaced with a three strand twist nylon rope. The ends on one of the ropes were whipped instead of looped. Evaluation results are included in the report.

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INTRODUCTION

This report describes what are essentially two development efforts. The first, a river crossing rope kit, and the second, stemming from it, a kit intended for both river crossing and mountaineering.

RIVER CROSSING ROPE KIT

Requirement

Crossing of rivers and streams was a daily occurrence for many military personnel in South Vietnam. Difficulty was often encountered with the use of existing river crossing equipment, and loss of personnel and equipment was experienced. One item causing problems was the Nylon Climbing Rope, MIL-R-1688. The nylon rope had an undesirable elongation during normal use which could result in loss of balance and hold on the rope. Also, the nylon rope absorbed considerable water, did not dry quickly and, when wet, was heavy to transport over land. Since the rope did not have any carrying containers, it easily became entangled on vegetation during transport. Another undesirable feature was that the rope quickly sank in water and was difficult to retrieve.

Description

Various types of ropes commercially available were investigated. Although several had most of the characteristics needed to overcome the problems being encountered, none possessed the characteristic of floating on the surface of fresh water which was deemed to be highly desirable. It became necessary therefore, to specially fabricate a rope having a density less than water and which also possessed all other required characteristics.

The ropes specially fabricated for durability and to float on water consisted of multifilament polypropylene core and a braided nylon cover. The average break strength of the 7/16 inch diameter rope was 4,300 pounds and for the 1/4 inch diameter rope was 1,700 pounds. All the ropes had four inch looped ends.

Snap links were included in the kit. These were standard issue (FSN 8465-360-0228). The ropes and snap links were separated into three light-weight nylon containers for ease of carrying. Packages I and II of the kit each contained one 120 foot, 7/16 inch diameter rope; five 12 foot, 1/4 inch diameter ropes and five snap links. Package III of the kit contained one 120 foot, 1/4 inch diameter rope; five 12 foot, 1/4 inch diameter ropes and five snap links. A nylon web carrying strap was provided for each container (see Figure 1).

Field Evaluation

Field evaluation of the River Crossing Rope Kit was conducted at the Florida Ranger Camp, Elgin Air Force Base, Florida. In general the ropes in the kit were considered to be superior to the standard rope for river crossing operations (see Appendix A).

In the report of evaluations of the River Crossing Rope Kit conducted by US Army Jungle Operations Training Center, Ft Sherman, Canal Zone it was stated that the new equipment was superior to existing ropes for

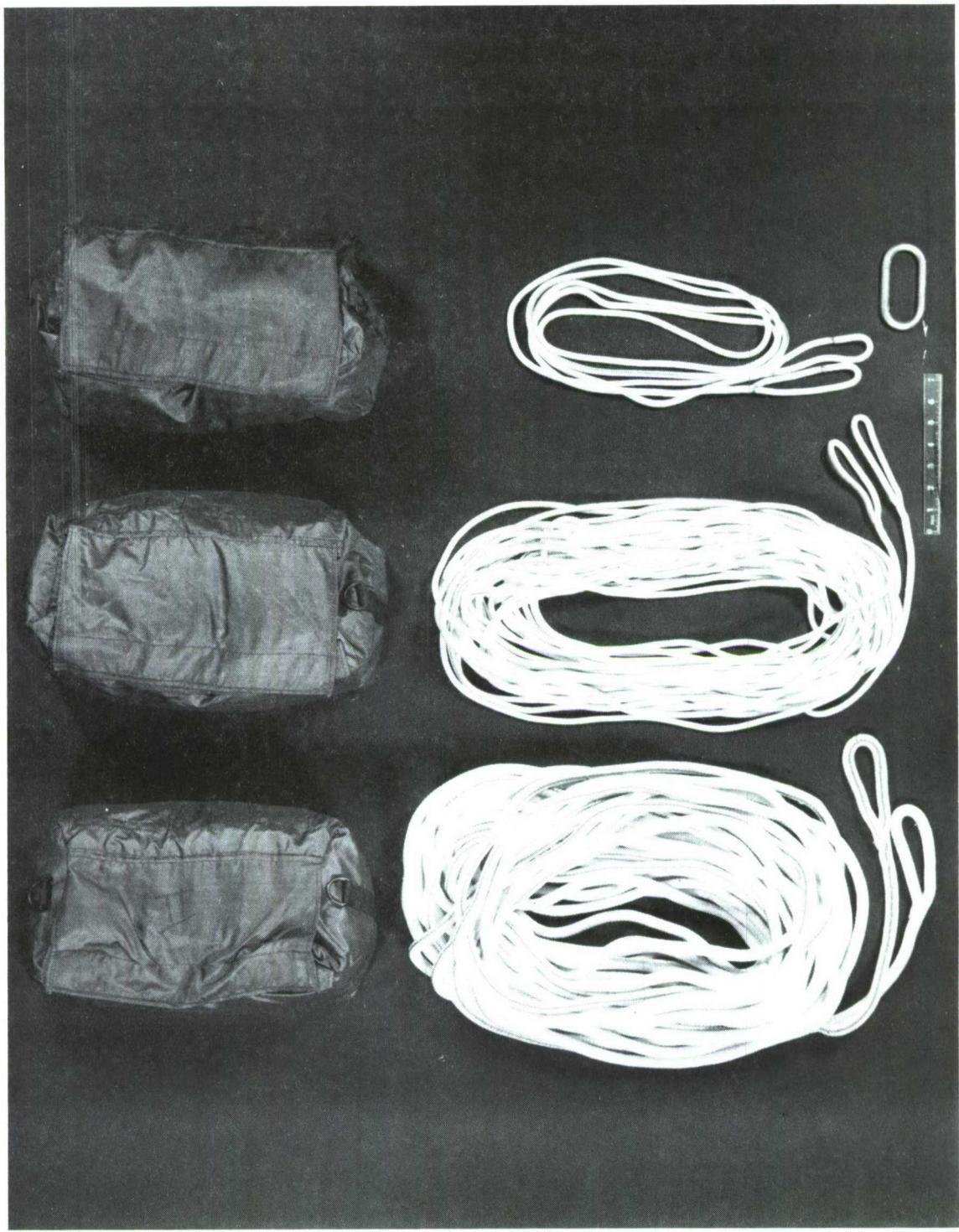


Figure 1. River Crossing Rope Kit

river crossing purposes but was not satisfactory for rappelling. The rough terrain of Panama required that small units be equipped for rappelling as well as river crossing. No explanation was offered as to why the ropes were deemed unsatisfactory for rappelling (see Appendix B).

The ropes in the River Crossing Rope Kit were extensively tested by US Army Land Warfare Laboratory personnel for suitability for rappelling. As a result of these tests it was concluded that the 7/16" diameter poly-propylene core/nylon braided cover rope was unsatisfactory for rappelling because there was little or no stretch and the rope was subject to excessive kinking while rappelling. The kinking apparently was a result of disproportionate stretch of the core and covers (see Figure 2).

The River Crossing Rope Kit was evaluated by the Royal Thai Army Special Warfare Center and RTA Engineers Department. In general the Rope Kit was favorably received (see Appendix C).

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Figure 2. Kinking

ROPE KIT,
SPECIAL PURPOSE MOUNTAINEERING AND RIVER CROSSING

Requirement

In response to one of the recommendations stemming from field evaluations of the River Crossing Rope Kit, the task was reoriented in an effort to incorporate a mountaineering capability into the kit. The use of separate kits for mountaineering and river crossing was unacceptable because of the logistic burden of having two kits and, operationally because a particular mission might require both river crossing and mountaineering operations.

Description

Redesigning a kit which was optimized for one specific function into a multipurpose kit immediately confronted the developer with conflicting requirements. The rope for river crossing was relatively small and light to permit easy portage and was designed to stretch as little as possible. It was easy to tie and untie. Since there was no concern about a sudden jerk on the rope or any likelihood of very great strain, the rope could readily be tailored to meet the desired characteristics. In mountain climbing, the rope must stretch to provide for a sudden drop; the likelihood of great stress on the rope is always imminent; and the assurance that a rope will not come untied assumes more importance than the mere ease of tying and untying. These conflicting characteristics plus the constraints of cost and availability made an apparently simple task into a series of challenging compromises.

Consideration was given to using as many items as possible from the River Crossing Rope Kit. The 120-foot, 1/4-inch diameter ropes and the 12 foot, 1/4-inch diameter utility ropes were converted for dual purpose use. The looped ends of the 120-foot, 1/4-inch diameter ropes were removed. Since the 120-foot, 7/16-inch diameter polypropylene core/nylon braided cover rope was determined to be unacceptable for rappelling, it had to be replaced. After an investigation of commercial ropes a 7/16-inch diameter three strand twist nylon continuous filament rope with a tighter than normal lay was chosen as the best candidate. The average break strength was 6,200 pounds. The rope retained over 90% of its strength when wet. The main advantage of this rope was its extremely tight lay which prevented dirt and rock fragments from getting between and cutting the filaments of the rope. The rope was the so-called "Mountain Climbing Gold Line" manufactured by Cordage Group, Auburn, NY 13021. The Rope Kit, Special Purpose Mountaineering and River Crossing which evolved from these changes consisted of two ropes 120 feet long and 7/16-inch diameter, one rope 120 feet long and 1/4-inch diameter, 15 ropes 12 feet long and 1/4-inch diameter and 15 snap links. The two 7/16-inch diameter ropes were the Gold Line described above. The 120-foot long, 1/4-inch diameter ropes were the same multi-filament polypropylene core with a braided nylon cover as were used in the River Crossing Kit except that the ends were whipped instead of looped. The snap links were standard issue (FSN 8465-360-0228).

The ropes and snap links were separated into three light weight nylon containers for ease of carrying. The containers were the same as used for the River Crossing Rope Kit. Package I and II of the kit each contained one 120-foot, 7/16-inch diameter rope; five 12-foot, 1/4-inch diameter ropes and five snap links. Package III of the kit contained one 120-foot, 1/4-inch diameter rope, five 12-foot, 1/4-inch diameter ropes and five snap links. A nylon web carrying strap was provided for each container (see Figure 3).

Field Evaluation: The Rope Kit, Special Purpose Mountaineering and River Crossing was evaluated at the Rangers Mountaineer Training Center, Dahlonega, Georgia during mountaineering training. Briefly, the results of the evaluation indicated a preference for the Standard A rope over the new ropes but the concept of a kit, i.e., providing nylon fabric carrying containers, was favorably received (see Appendix D).

A field evaluation of the Rope Kit by the 10th Special Forces at Fort Devens, MA is scheduled for spring and early summer 1974. No results of this evaluation are available at this time.

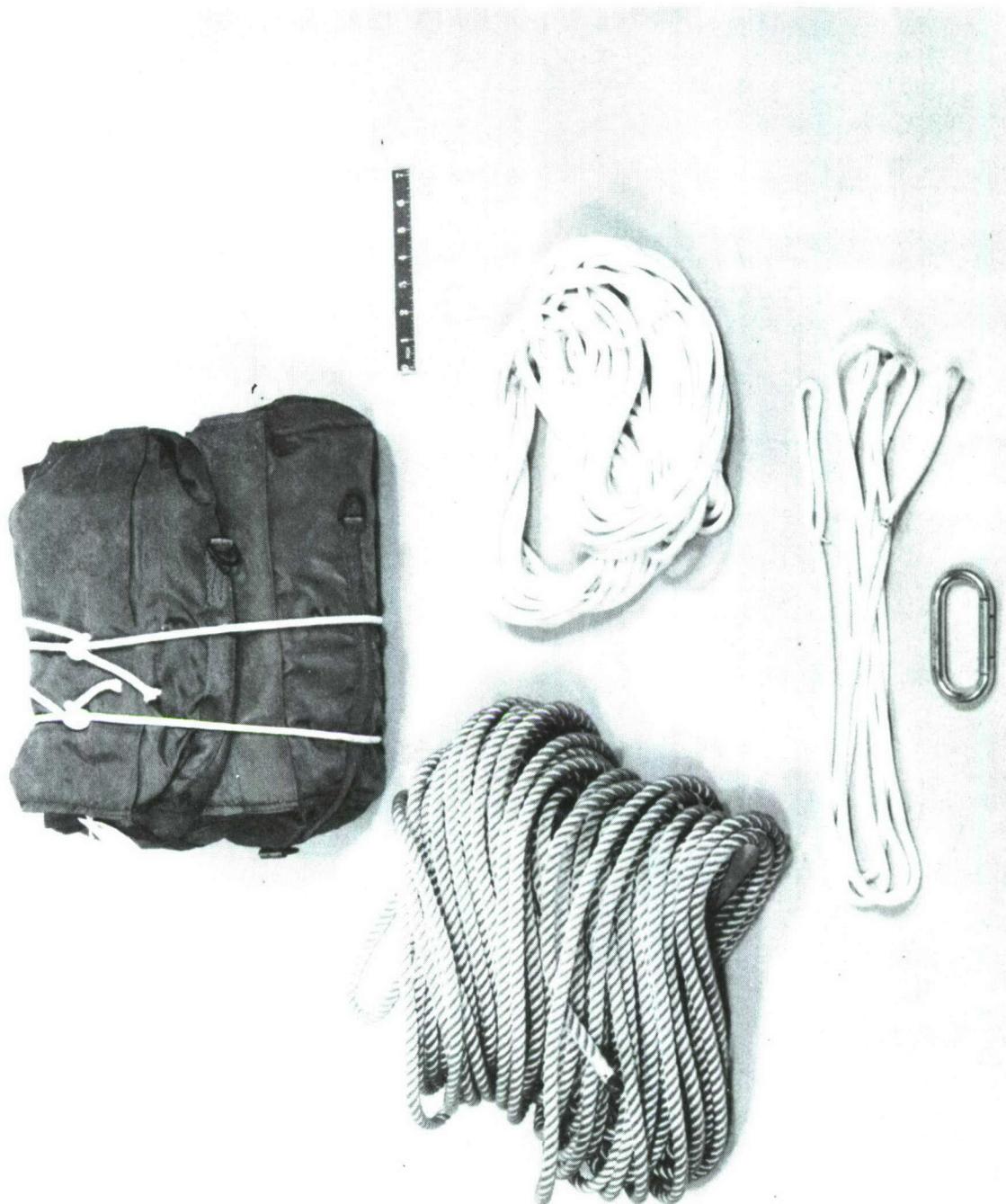


Figure 3. Rope Kit, Special Purpose Mountaineering and River Crossing

CONCLUSION

It is concluded that the River Crossing Rope Kit was satisfactory, except for minor deficiencies, for river crossing operations but unsatisfactory for dual purpose river crossing and mountaineering operations. The Rope Kit, Special Purpose Mountaineering and River Crossing is a sound concept but the ropes in the kit should be replaced by Standard A climbing ropes and Standard A utility ropes.

APPENDIX A

TEST RESULTS OF SMALL UNIT RIVER CROSSING EQUIPMENT

DISPOSITION FORM

For use of this form, see AR 340-15; the sponsor agency is The Adjutant General's Office.

REFERENCE OR OFFICE SYMBOL

SUBJECT

AT SIN-R-FRC

Test Results Of Small Unit River Crossing Equipment

TO Mr. Hardenbrook

FROM Commanding Officer

DATE 7 Dec 71

CMT 1

ALWL

Florida Ranger Camp

Aberdeen Proving Ground, Md.

Eglin A.F. Base, Fla.

I Scope: Field Tests were administered using the Small Unit River Crossing Equipment. The results of the test are contained in this report.

II Results:

A. Positive Aspects:

1. The weight of the test rope when wet is less than half that of the standard rope.
2. The new test rope does not fray.
3. The test rope is easier on the hands without being difficult to hold.
4. The test rope absorbs little or no water.
5. All ropes in the test kit (except for the main rope) are of satisfactory length.

B. Negative Aspects:

1. The knots used to construct a transport tightening system (one-rope bridge) with the test rope could not include a quick release for this would cause the rope to slip at that knot.
2. The 120 foot main test ropes were not long enough for use on the large rivers here in Florida.
3. The test rope kit bag was not of sufficient durability to withstand prolonged use in the field.

III Recommendations:

- A. Devise an anchor knot which will include a quick release that doesn't allow the rope to slip.
- B. Lengthen the main ropes to a 220' length.
- C. Construct a more durable kit bag.

IV Conclusion: If the recommended changes are made we will have a small unit river crossing kit worthy of replacing the one presently in use.

V Enclosures:

- A. One kit bag.
- B. Ten evaluation questionnaires

Note: These questionnaires were prepared by personnel with only limited exposure to both the standard and test ropes. Their conclusions should only be considered as having marginal validity.

DA FORM 1 FEB 62 2496

REPLACES DD FORM 96, EXISTING SUPPLIES OF WHICH WILL BE ISSUED AND USED UNTIL 1 FEB 63 UNLESS SOONER EXHAUSTED.

ATSIN-R-FRC (7 Dec 71)

SUBJECT: Test Results Of Small Unit River Crossing Equipment

The Florida Ranger Camp greatly appreciates having the opportunity to test this new rope. If we can be of any further assistance please feel free to contact us.

William D. Old II
WILLIAM D. OLD, II
LTC IN
Camp Commander

APPENDIX B

**REPORT OF THE EVALUATIONS CONDUCTED FOR THE
US ARMY LAND WARFARE LABORATORY
10 JANUARY 1972**


DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY FORCES SOUTHERN COMMAND
APO NEW YORK 09334

IN REPLY REFER TO

SCARGC-CD

10 JAN 1972

SUBJECT: Report of Evaluations Conducted for the US Army Land Warfare Laboratory

Commanding Officer
USA Land Warfare Laboratory
ATTN: CRDLWL-9C
Aberdeen Proving Ground, Maryland 21005

1. The Small Unit River Crossing Equipment Sets were evaluated by the USA Jungle Operations Training Center in November 1971. The completed questionnaire concerning the evaluation is inclosed.
2. Additional comments concerning the river crossing equipment by JOTC personnel are as follows.
 - a. The braided nylon casing of the new ropes makes them very slippery particularly when the hands are wet.
 - b. The ropes are easier to untie than the present nylon ropes but it is felt that the ropes do not hold a knot well enough.
 - c. In terms of weight and resistance to wear the new ropes are superior to the present nylon ropes.
 - d. The little or no stretch feature of the new rope is a desirable characteristic since the nylon ropes will stretch up to 30% depending upon age and usage. This stretch must be accommodated by repeated tightening during usage.

10 JAN 1972

SCARGC-CD

SUBJECT: Report of Evaluations Conducted for the US Army Land
Warfare Laboratory

e. The new equipment is superior to the existing ropes for river crossing purposes; however, it is not satisfactory for rappelling. The rough terrain of Panama requires that small units be equipped for rappelling as well as river crossing. The present nylon rope can be used for both purposes. While the new equipment is superior for river crossing purposes, it is felt the advantages offered do not warrant further burdening the small units in the jungle environment with another set of equipment.

f. The ideal solution would be to develop a dual purpose rope that includes the desirable features of the new rope. Possibly this can be achieved by developing a new casing for the polypropylene center of the new rope.

3. The burnable plastic discs for heating rations have the complete approval of the JOTC personnel. They are far superior to anything developed so far. Recommend that they be included in all appropriate ration packages.

FOR THE COMMANDER:

1 Incl
as


B. B. BOROWSKI
CPT, AGC
Assistant Adjutant General

APPENDIX C

REPORT OF EVALUATION CONDUCTED FOR THE
US ARMY LAND WARFARE LABORATORY
14 JANUARY 1974



MILITARY RESEARCH AND DEVELOPMENT CENTER
SUPREME COMMAND HEADQUARTERS
MINISTRY OF DEFENSE
BANGKOK, THAILAND

No. MOD 0309(07)/140

14 January 1974

SUBJECT : Report of Evaluation Conducted for the US Army Land Warfare Laboratory

THRU : Lieutenant General PIYA SUWANPIM
Director, Education and Research
Supreme Command Headquarters

MEMORANDUM FOR : Commander
USMACTHAI/JUSMAGTHAI (ATTN: MACTRD)

1. The Small Unit River Crossing Equipment Sets were evaluated by the RTA Special Warfare Center and RTA Engineer Department in November 1973. The completed questionnaire concerning the evaluation is enclosed.

2. Additional comments concerning the River Crossing Equipment by Special Warfare Center and Engineer Department personnel are as follows:

- a. During normal use, failures were noted in the Safety Line. The eye splices had partially pulled loose and in several places the rope's inner core was protruding through the outer nylon sheathing where the elongated woven Polypropylene inner core of the Safety Line did not contract to its original length after being stretched through use.
- b. The ropes are difficult to completely re-insert in the provided carrying case after use. A muddy, wet rope is very difficult to re-pack particularly at night. Slightly larger carrying case should be provided.
- c. The instruction sheets provided by USALWL are not sufficient. The relation between the width of the river and the distance of snap link from its proposed anchor is not accurately stated in

the instruction provided. The instruction sheet suggests the snap links be placed 6 to 8 feet (for each 120'f rope) from its anchor point. Field use indicated that 8 to 12 feet was a more practical figure.

3. All shortcomings that were noted, however, were minor in nature and correctable. The overall opinion of the field testing units was that the kit was extremely useful and would be a desirable addition to the TOE for the RTA.

4. The MRDC Final Report will be forwarded as soon as all data has been evaluated.

P. Mokkhaves.

PRASART MOKKHAVES
Major General, RTA
Commanding General, MRDC

Encl. 1

Questionnaire for the Rope Kit, River Crossing

Computer Result:

- A frequency count was used to find the mode of each variable.
- The sample size is 236 men.
- The No. of variables 55.
(55 questions in each questionnaire)

COMMAND'S COMMENTS

1. Type and duration of Mission:
 - River Crossing
 - 1 hour
2. The use of the rope kit increased the unit's ability to accomplish its mission. Because we don't have this kit in TOE of RTA before.
3. The instructions for user are inadequate as detailed in the Report of Evaluation paragraph C.
4. The number of ropes in the kit is satisfactory.
5. The lengths of the ropes in the kit are satisfactory.
6. They were 236 men in the exercise.
7. The water was fresh.
8. Other comments/recommendations.
 - Please include some more snap links.
 - Please include some gloves in the kit to aid in pulling the rope tight when it is being anchored.

USER'S COMMENTS

1. The carrying containers are satisfactory.
2. Average width of the river; 10-50 Metres.
3. Average velocity of the current; 3 Knots.
4. All weather exercise.
5. The method of joining the 120 feet, 7/16 inches diameter rope to the 120 feet, 1/4 in. diameter rope using a snap link in the end loops is satisfactory.

6. Time for swimmer to cross the river; 1-3 minutes.
7. The swimmer didn't have any difficulty swimming the rope across the river.
8. Once across the river, the swimmer didn't have any difficulty pulling the 120 feet, 7/16 inches diameter rope across.
9. The swimmer didn't have any difficulty tightening the 120 feet, 7/16 inches diameter rope to the anchor point.
10. The soldiers who pulled the rope bridge as taut as possible didn't have any difficulty.
11. All of the knots held securely.
12. The equipment which was carried while crossing the river:-

Weight; 30 lbs.

Description; (1) All kinds of weapons
(2) Army Gear

13. The method of joining the looped end of the 12 feet, 1/4 inch diameter safety rope to the rope bridge was very satisfactory.
14. The equipment transported over the river using the 120feet, 1/4 inch diameter rope was:-

Weight; 25 lbs (average).

Description;	(1) Weapons	69.49 %
	(2) Bullets	7.20 %
	(3) Patients	12.71 %
	(4) Miscellaneous	10.60 %

15. No difficulty was found in sliding the equipment over the rope bridge.
16. The rope was easy to handle.

17. *It was easy to untie the knots.*
18. *The ropes absorbed a little water but dried quickly again.*
19. *The ropes were damaged a little bit, i.e., the skin of the rope was torn a bit (not much and not dangerous).*
20. *The snap links remained in good conditions.*
21. *The carrying containers remained in good condition.*

APPENDIX D

**SUMMARY REPORT OF FIELD EVALUATION OF ROPE KIT,
SPECIAL PURPOSE MOUNTAINEERING AND RIVER CROSSING
USALWL TASK NO. 03-S-70**

DEPARTMENT OF THE ARMY
RANGER DEPARTMENT
75TH INFANTRY (RANGER)
UNITED STATES ARMY INFANTRY SCHOOL
Fort Benning, Georgia 31905

ATSH-R

25 October 1973

SUBJECT: Summary Report of Field Evaluation of Rope Kit,
Special Purpose Mountaineering and River Crossing,
USALWL Task No. 03-S-70

Commander
United States Army Land Warfare Laboratory
ATTN: AMXLW-DES/Mr. J. L. Carney
Aberdeen Proving Ground, Maryland 21005

1. Summation of Test Results:

a. The Rope Kit, Special Purpose was tested by Ranger students, supervised by Ranger cadre, who were undergoing mountaineering training to include squad training in river crossing techniques, in the North Georgia mountains.

b. The Rope Kit is considered satisfactory for a one time operation by experienced personnel, but is considered inadequate for continuous use such as Ranger mountaineering training because of difficulty in handling the Goldline ropes once they have become exposed to the elements.

c. The twelve foot, one quarter inch, polypropylene core, utility rope frayed and began working back through the braided nylon cover after sixty minutes of continuous use. It also cut into the rappeller's body and was very uncomfortable.

d. The one hundred twenty foot, one quarter inch, polypropylene core rope was not tested because there was not a river of sufficient depth within the training area.

2. Recommendations:

a. That the Goldline climbing rope not replace the present Standard A climbing rope.

b. That the twelve foot, one quarter inch, polypropylene core utility rope not replace the present Standard A utility rope.

ATSH-R

25 October 1973

SUBJECT: Summary Report of Field Evaluation of Rope Kit, Special Purpose
Mountaineering and River Crossing, USALWL Task No. 03-S-70

c. That the Rope Kit, Special Purpose be modified to consist of two one hundred twenty foot Standard A climbing ropes, six twelve foot Standard A utility ropes, and six Standard A snaplinks, and that it be issued to all Infantry units on a "as needed" basis.

FOR THE DIRECTOR:

1 Incl
Letter, Field Evaluation
of Rope Kit, Special Pur-
pose, AMXLW-DES, 5 Sep 73

CF:
Dir, CD, USAIS



HENRY J. OSTERHOUDT
Captain, Infantry
Administrative Officer

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